

WRF DTE

Verification Statistics for
February 2003

NOAA FSL

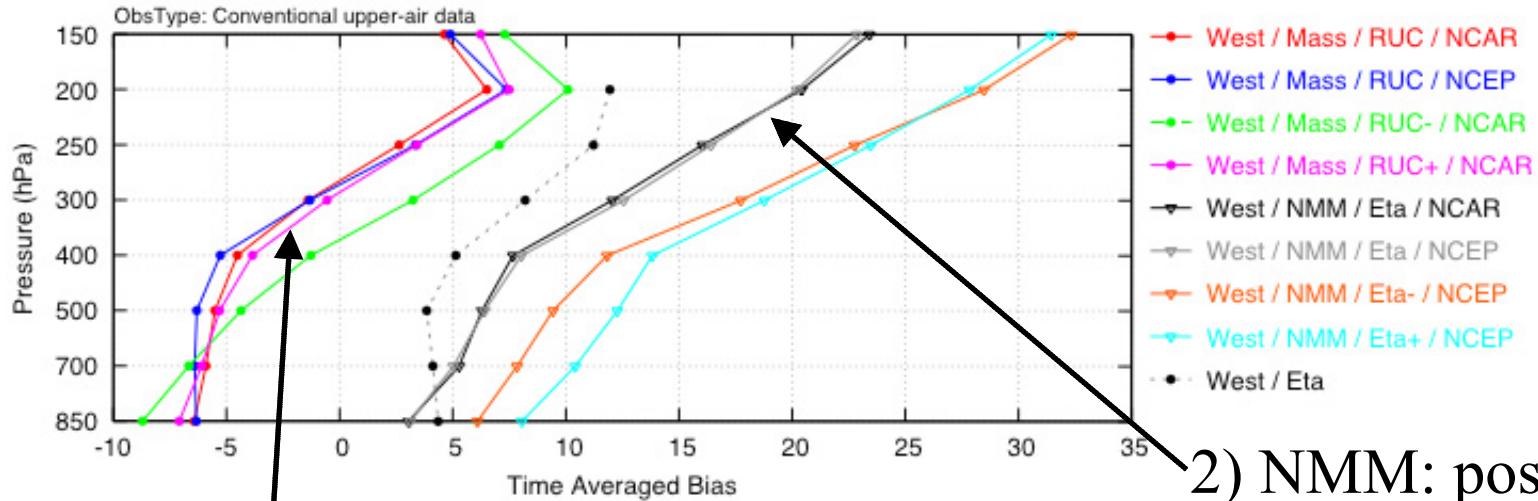
Lígia Bernardet

Andrew Loughe

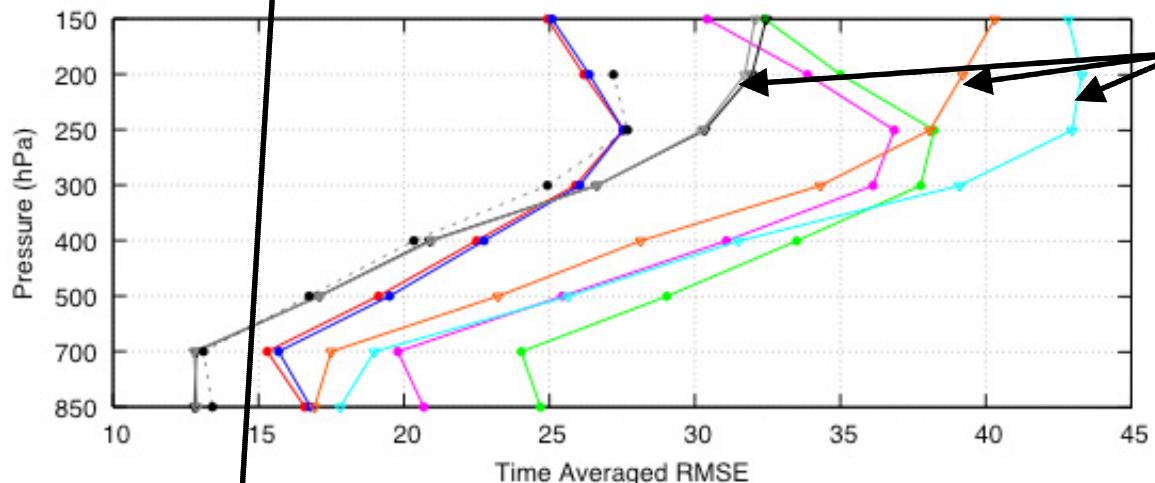
Steve Koch

4/29/2004

Height (Z) Forecast Hour=ALL February 1 - 28, 2003



2) NMM: pos bias



3) NMM-SI error: large RMS at upper levels

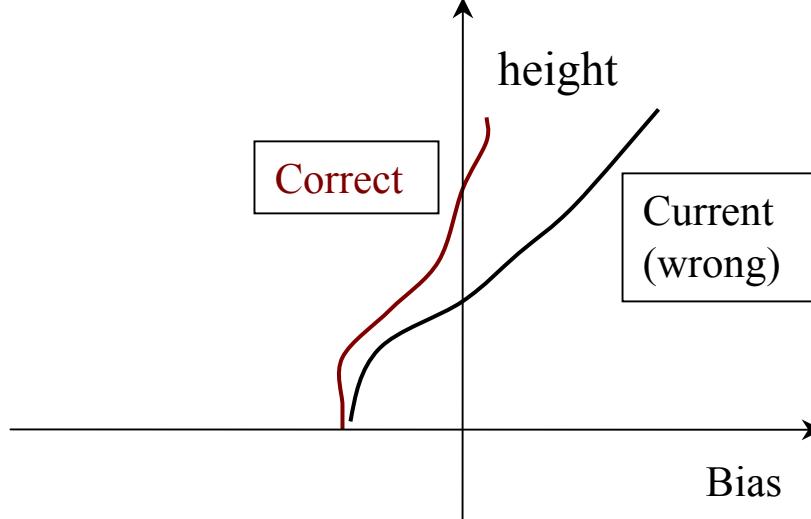
1) EM: neg bias low levels, pos bias above

WRF/DTC

NMM height bias

- Zavisa Janjic 4/23/2004
- Problem NMM SI on IC and BC from ETA
- Inconsistency between hydrostatic equation in ETA and NMM SI
- Causes large geopotential error
- Especially Central Domain

EM height bias



WRF outputs Geopotential (F), so geopotential height is calculated by NCEP POST. POST used 9.8 ms^{-2} , but to be consistent with WRF should have used 9.81 ms^{-2} .

$$\text{Bias}_C = F/9.81 - O \quad \text{Bias}_W = F/9.8 - O$$

$$\text{Error} = \text{Bias}_W - \text{Bias}_C = F/9.8 - F/9.81 = (9.81F - 9.8F)/(9.8 \times 9.81) = 0.01F/(9.8 \times 9.81) \sim 10^{-4} F > 0, \text{ since } F > 0.$$

Therefore, the correct curve is to the left of the one shown in web site.

Problem is larger at upper levels:

If $F = 15,000 \text{ m}^2\text{s}^{-2}$, error is $\sim 1.5 \text{ m}$.

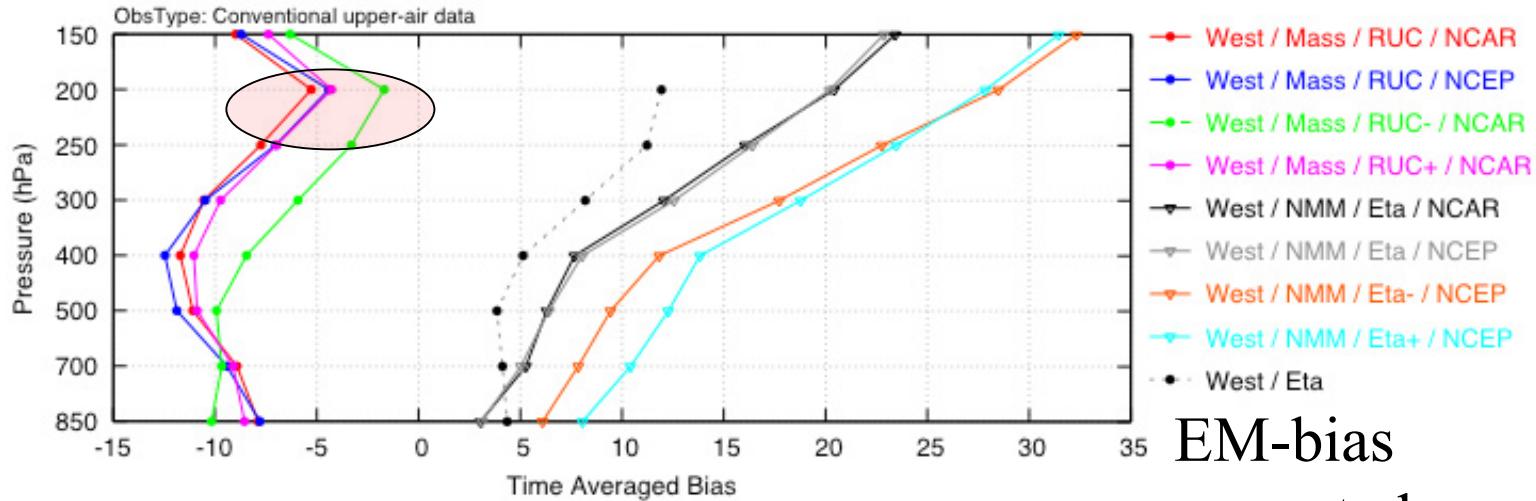
If $F = 100,000 \text{ m}^2\text{s}^{-2}$, error is $\sim 10 \text{ m}$.

Proposed correction based on Standard Atmosphere:

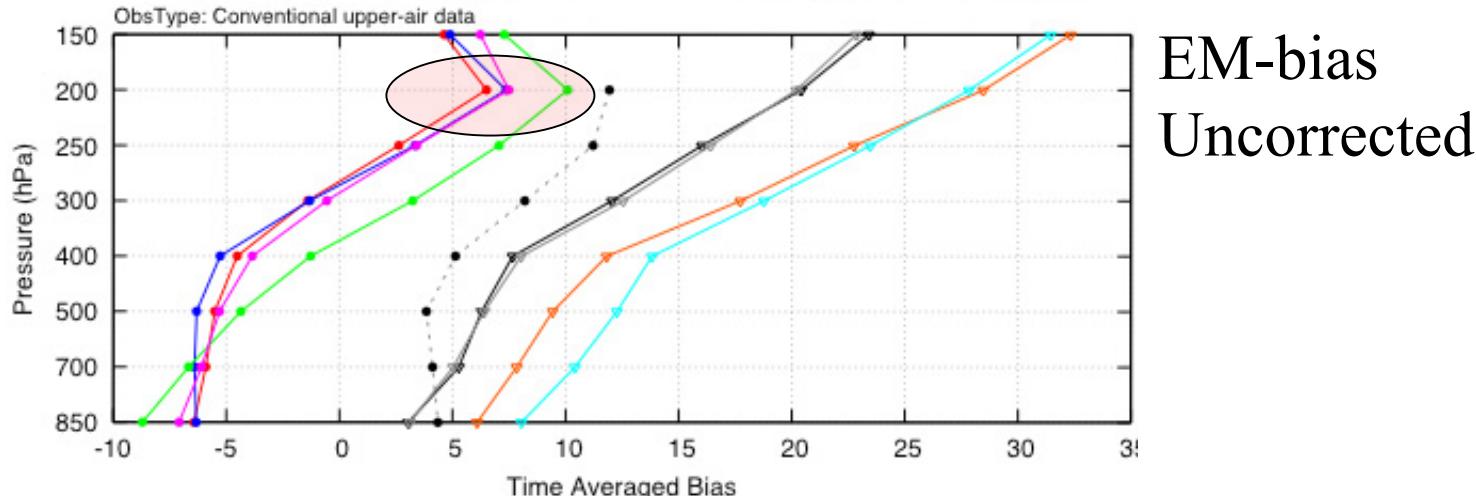
Level 850 hPa - $Z = 1457 \text{ m}$ - Subtract 1.47 m

Level 500 hPa - $Z = 5574 \text{ m}$ - Subtract 5.57 m

Height (Z) Forecast Hour=ALL February 1 - 28, 2003

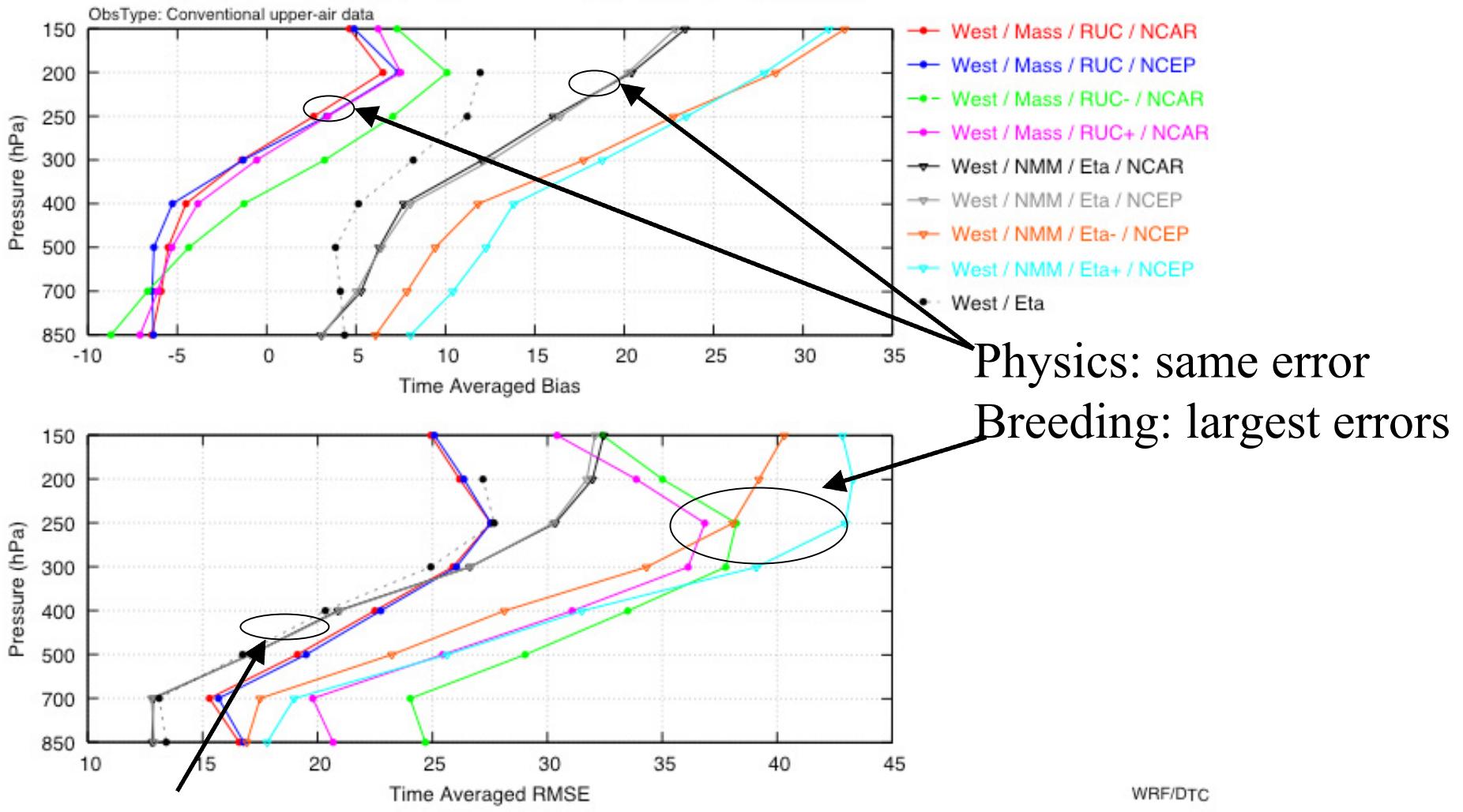


Height (Z) Forecast Hour=ALL February 1 - 28, 2003



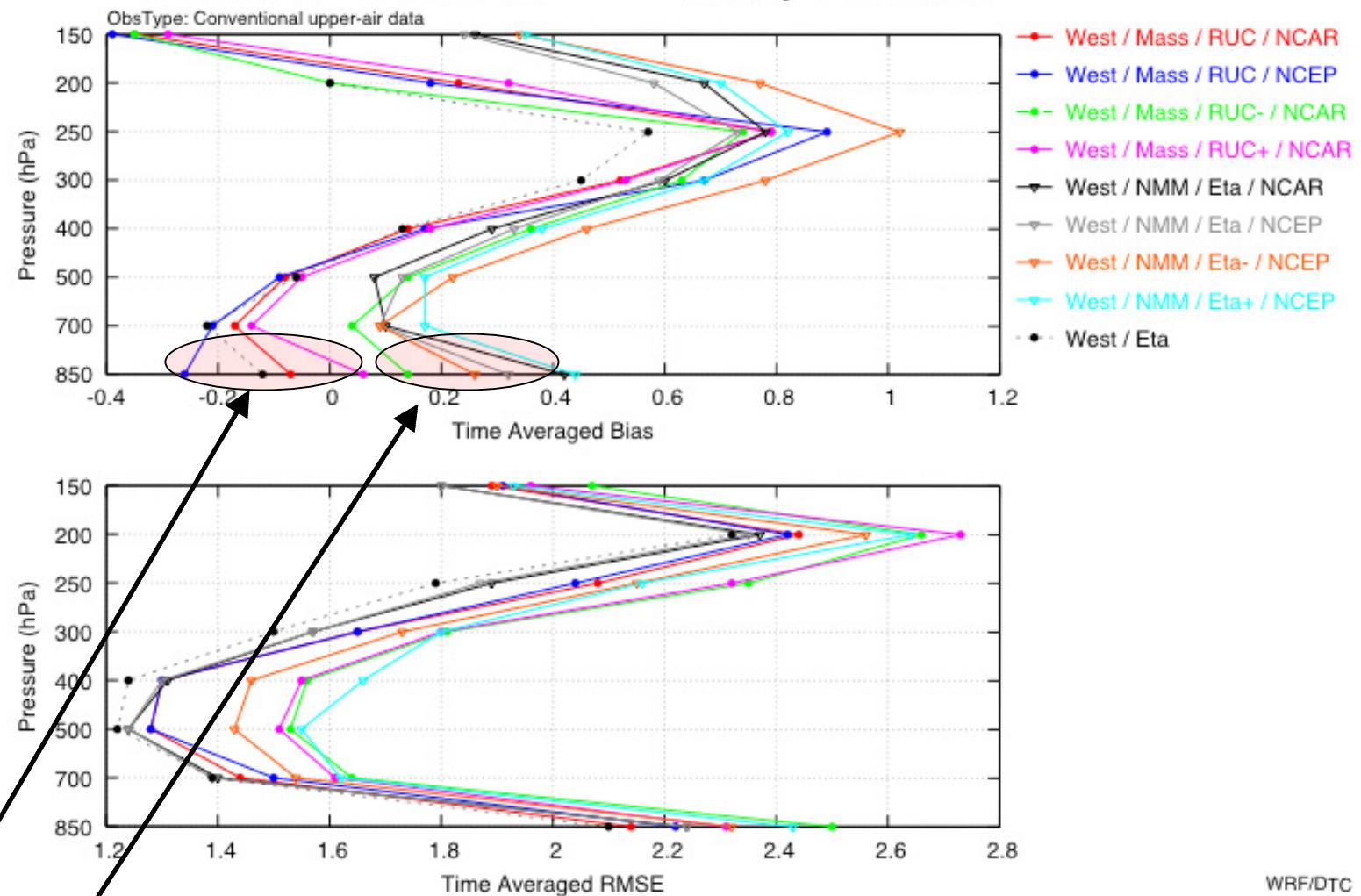
Correction has *not* been applied in any other slide or on the web page.

Height (Z) Forecast Hour=ALL February 1 - 28, 2003



Hard to beat ETA

Temperature Forecast Hour=ALL February 1 - 28, 2003

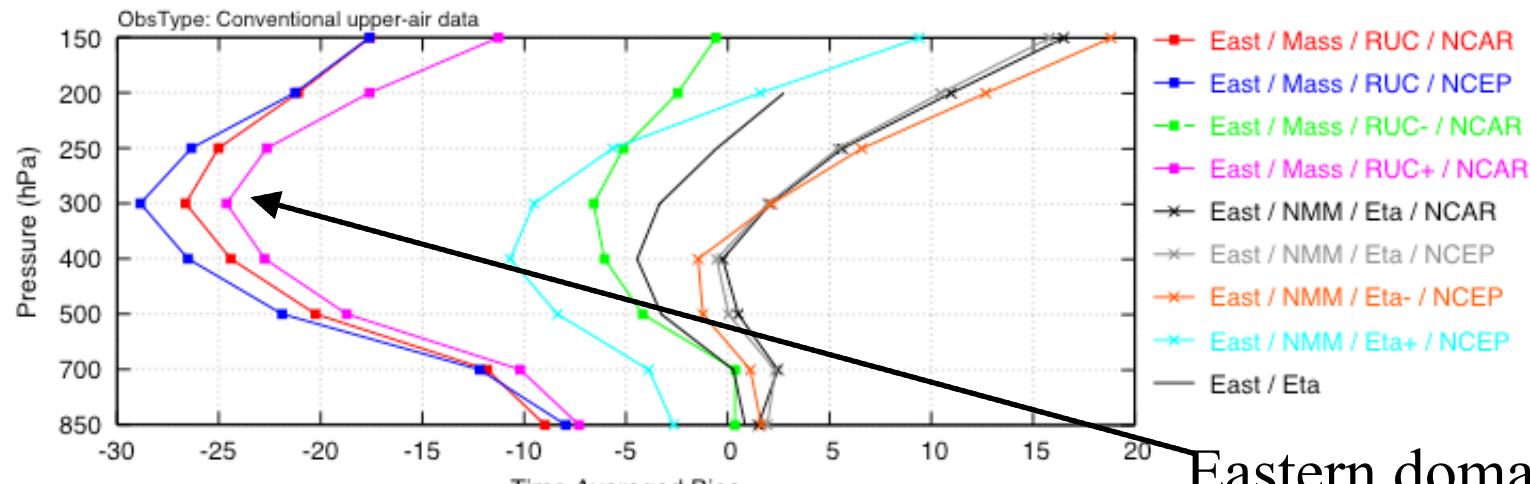


EM-RUC cold low levels

NMM-ETA warm low levels

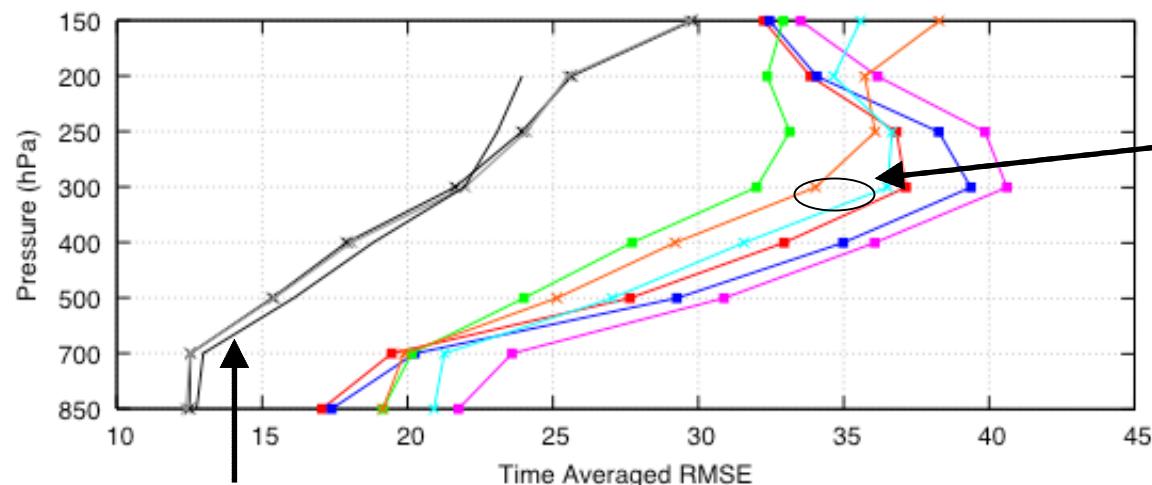
Dynamical core matters more than soil/PBL scheme

Height (Z) Forecast Hour=ALL February 1 - 28, 2003



Eastern domain is different:
EM- large negative bias

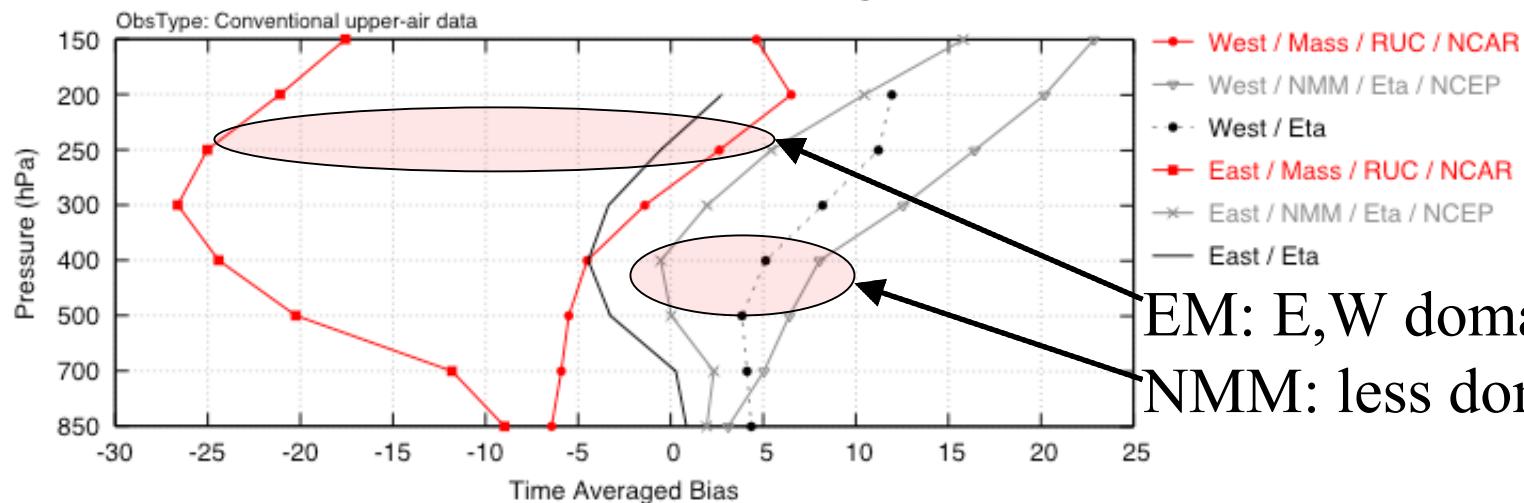
NMM: breeding has
more error than baseline



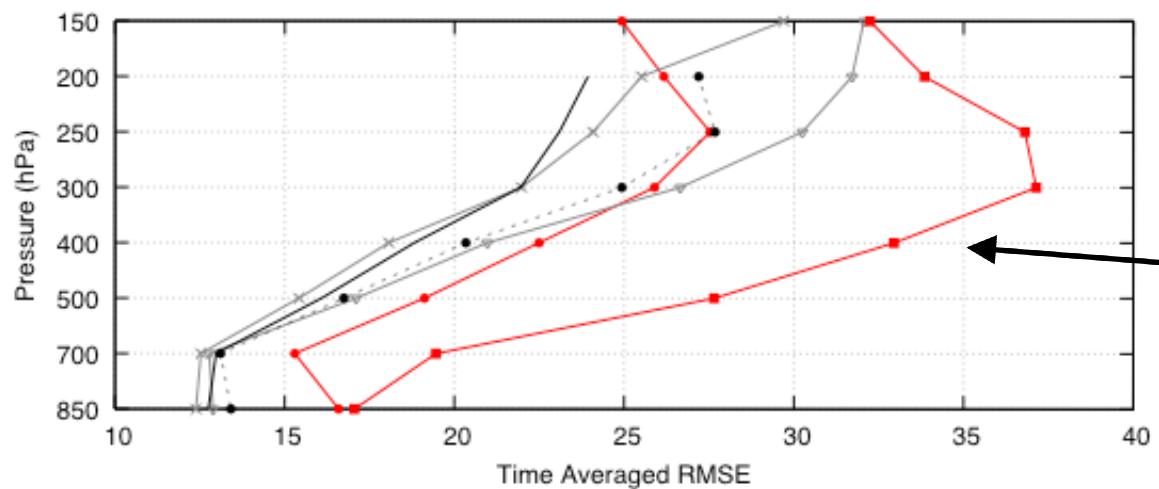
WRF/DTC

ETA and NMM-NCEP: smallest RMSE

Height (Z) Forecast Hour=ALL February 1 - 28, 2003

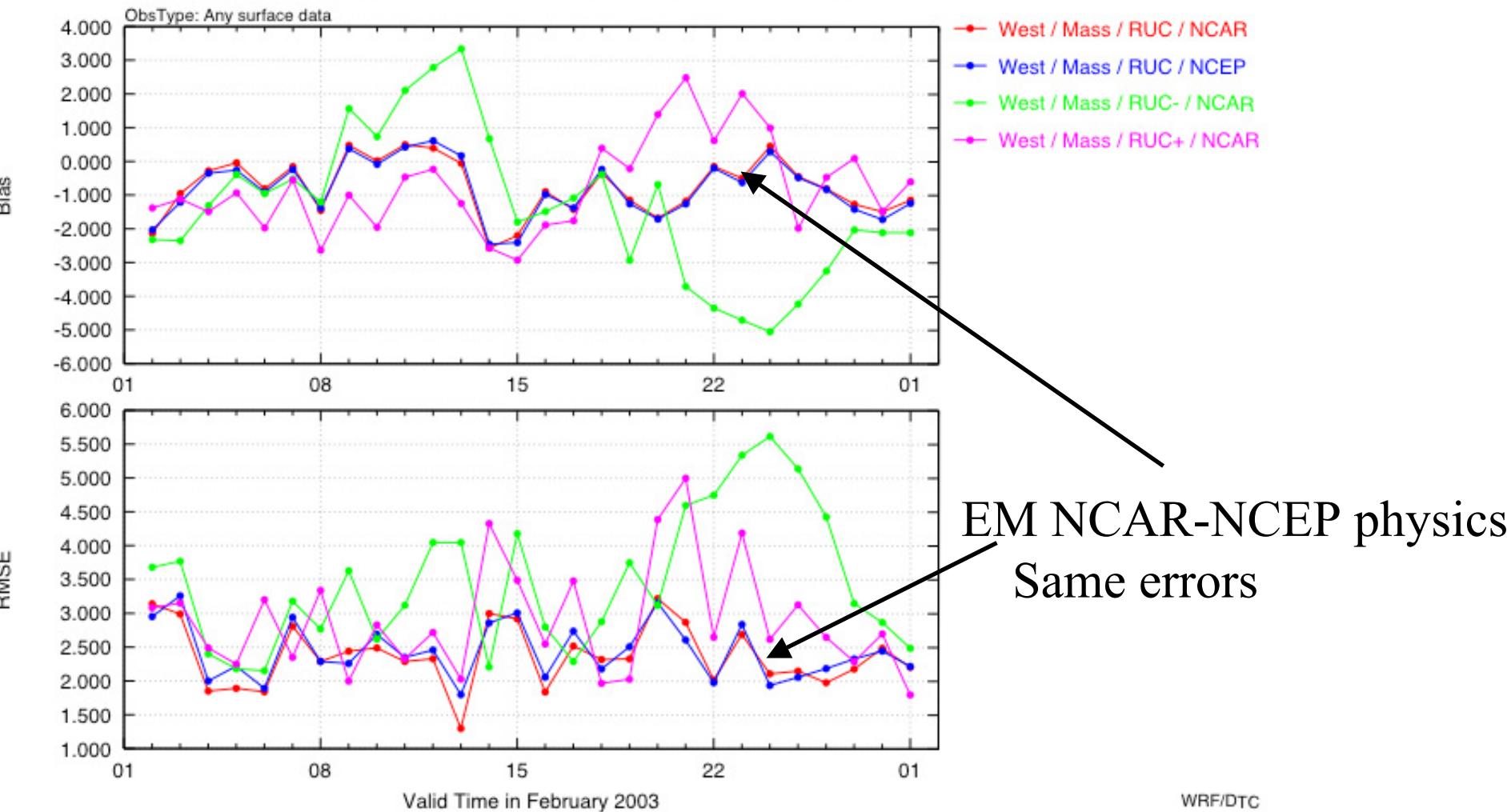


EM: E,W domains differ
NMM: less domain differ



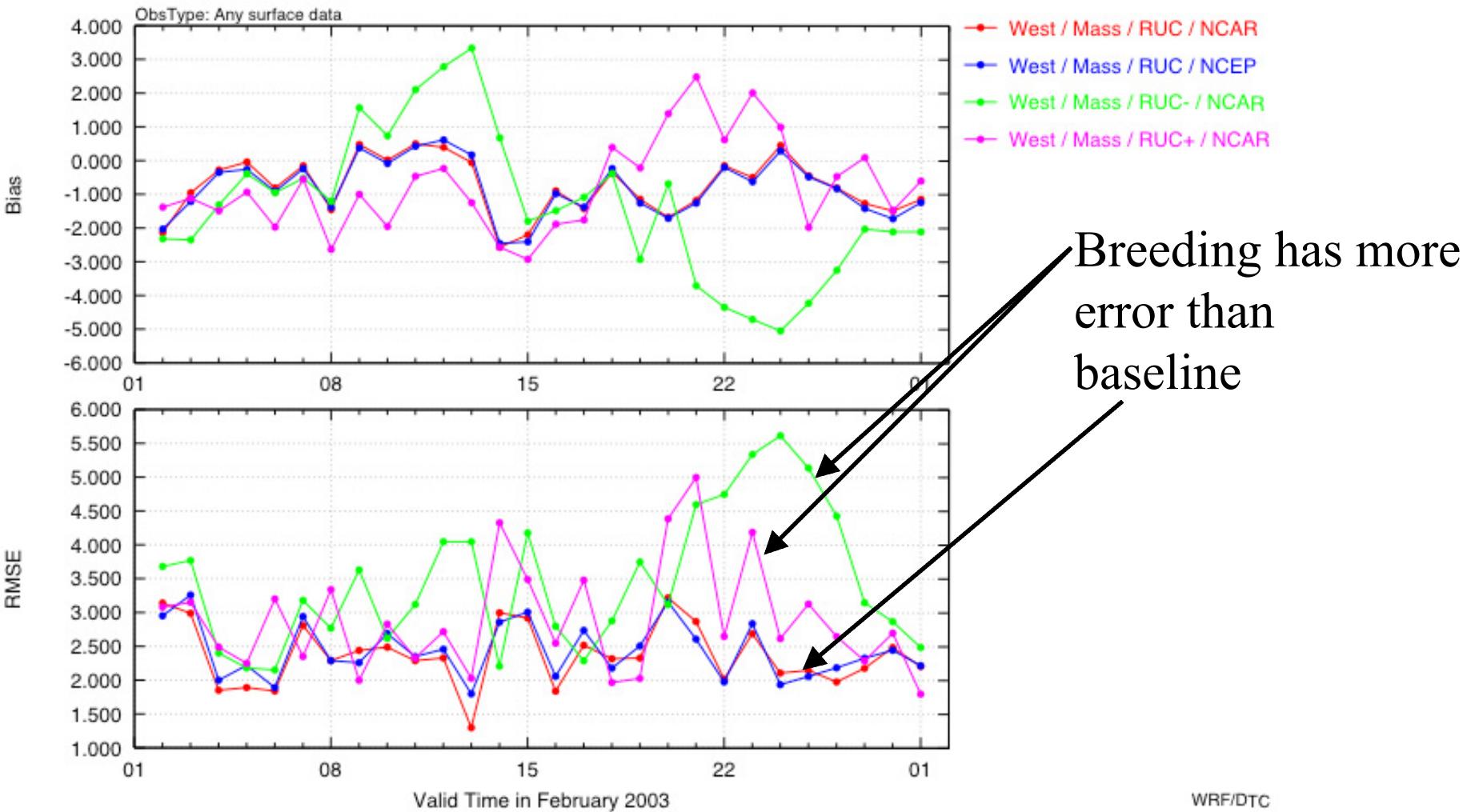
WRF/DTC

SLP Forecast Hour=18 February 1 - 28, 2003

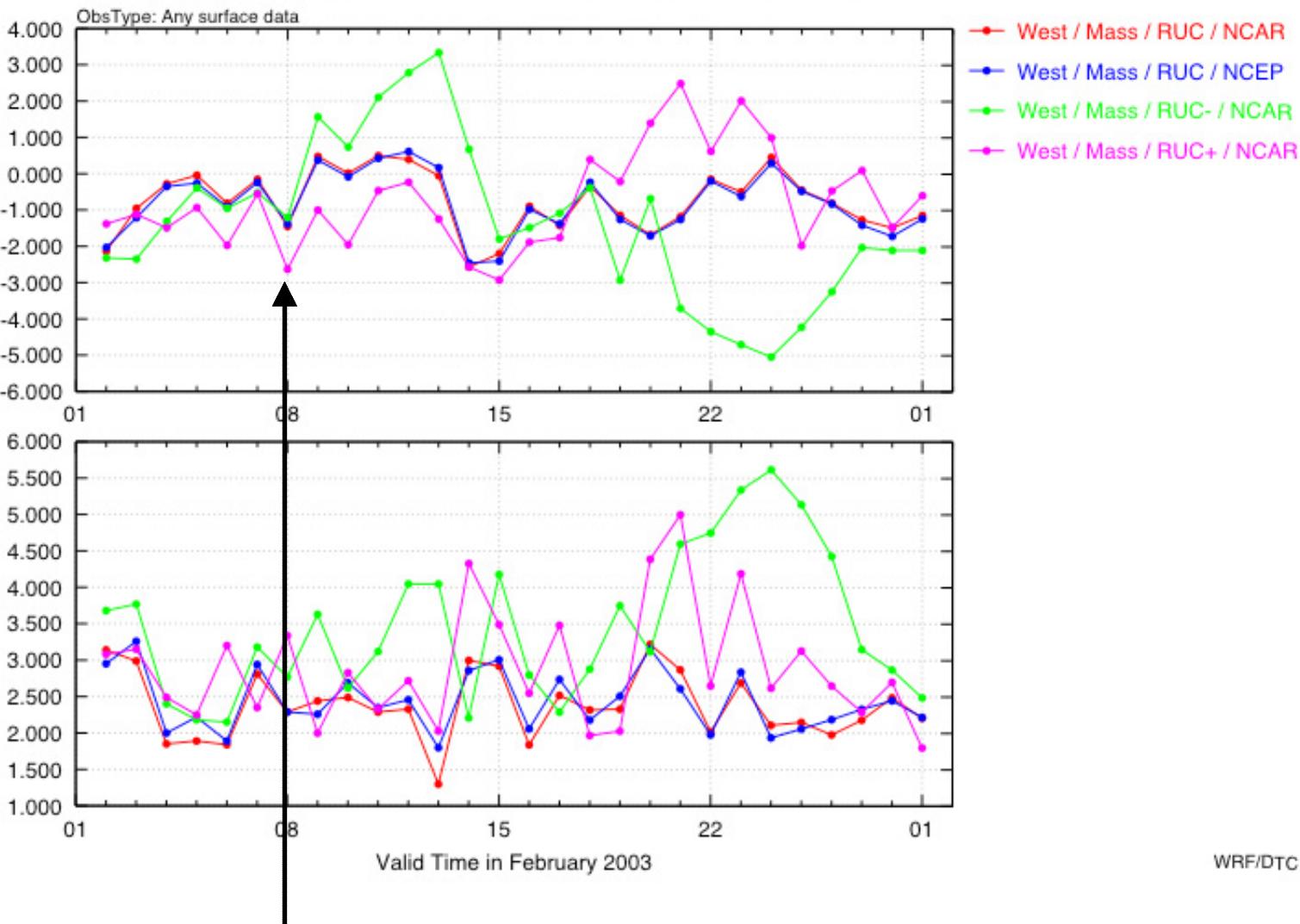


High day-to-day variability.

SLP Forecast Hour=18 February 1 - 28, 2003

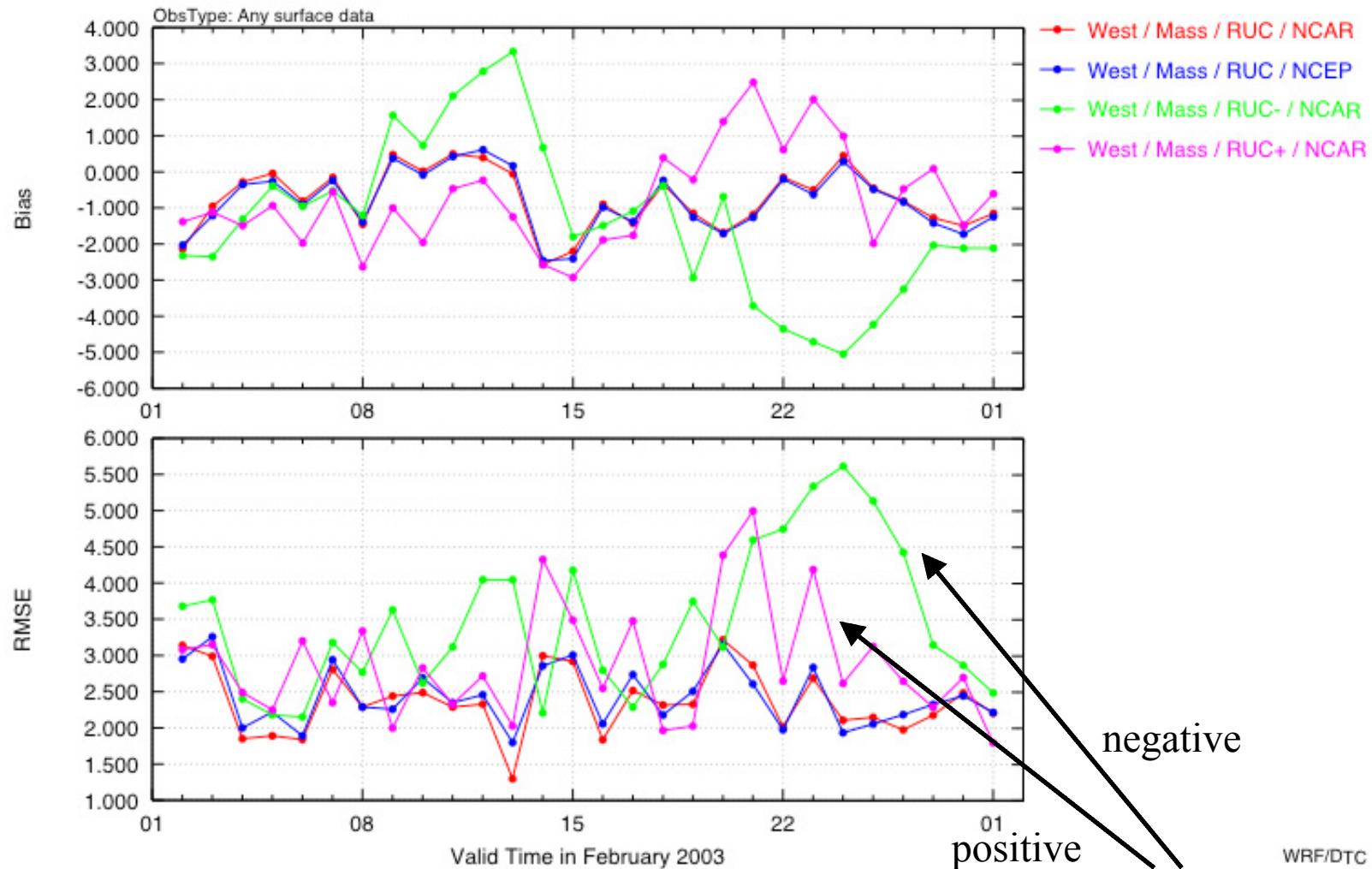


SLP Forecast Hour=18 February 1 - 28, 2003

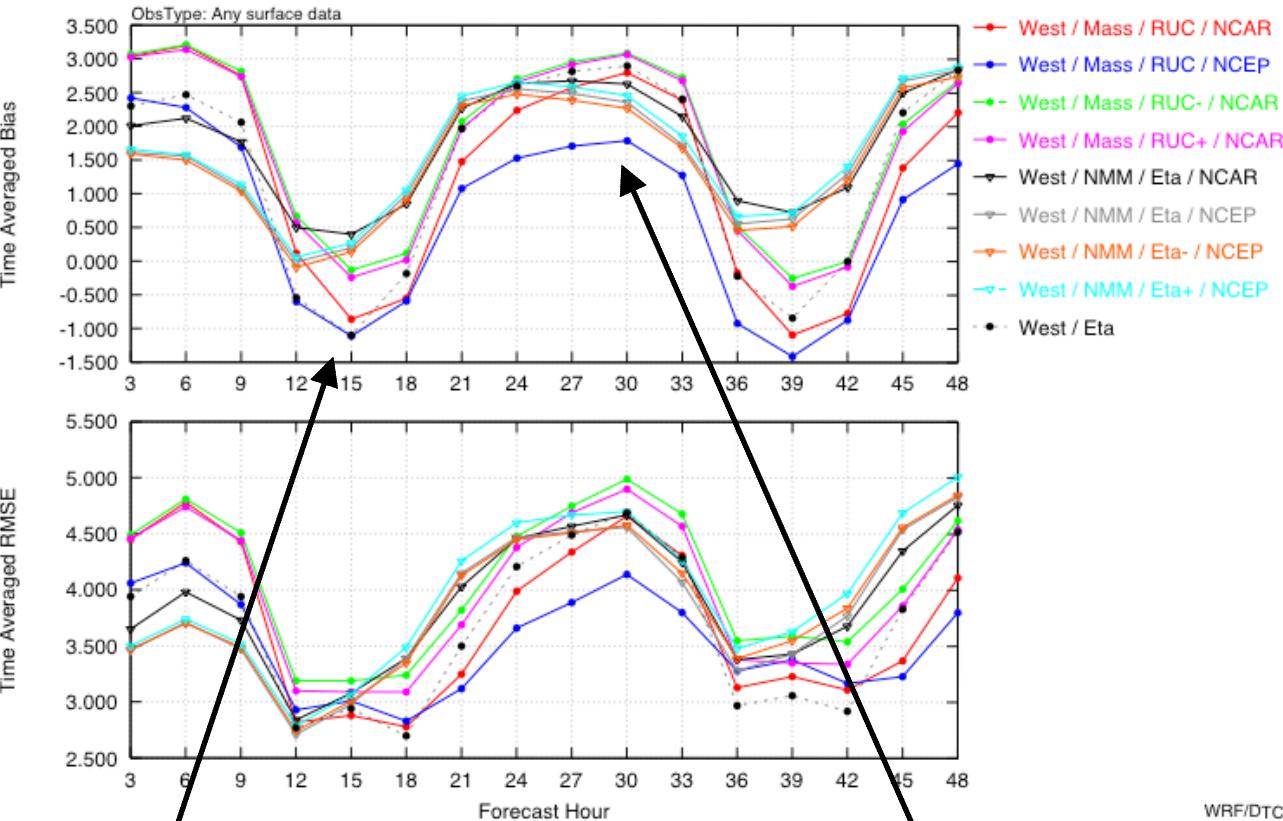


Breeding takes a week to bring variability

SLP Forecast Hour=18 February 1 - 28, 2003



NSTREAM has larger errors than PSTREAM
Why?



Diurnal Cycle of Errors

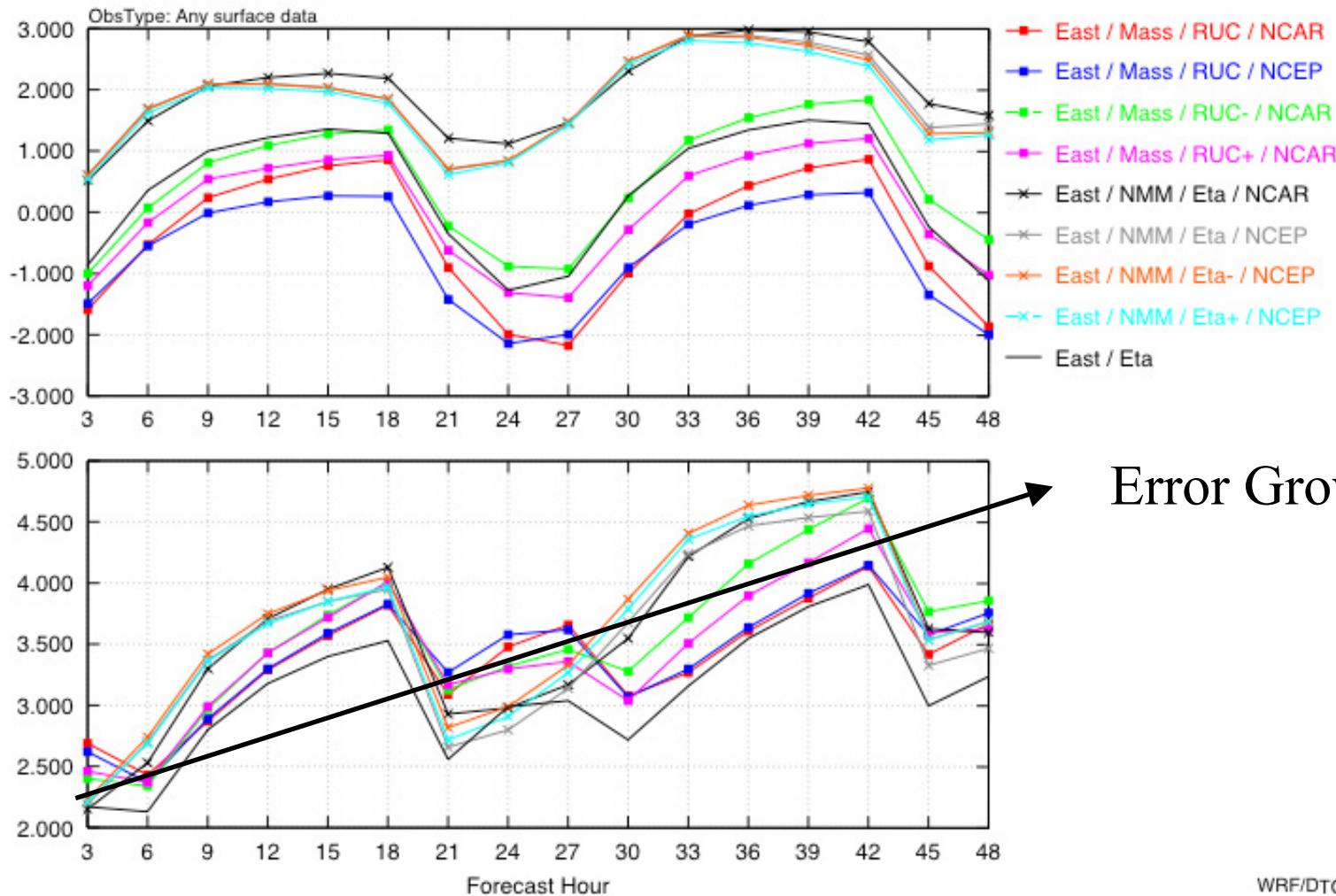
W domain: starts at 06 UTC -8 = 22 PST

15 hrs = 1 PM (T_{max} is too low) / 30 hrs = 4 AM (T_{min} is too low)

Diurnal Cycle is flat.

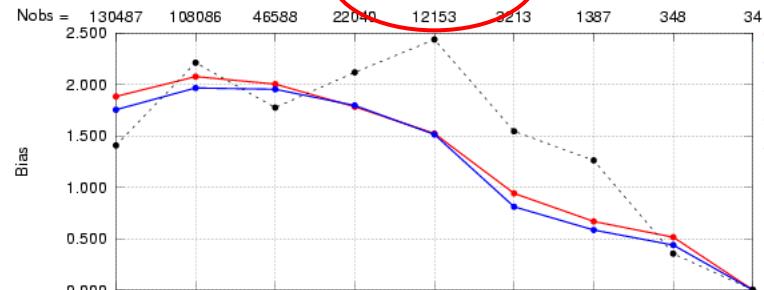
E domain: T cycle is similar to W

SFC Temperature Forecast Hour=ALL February 1 - 28, 2003

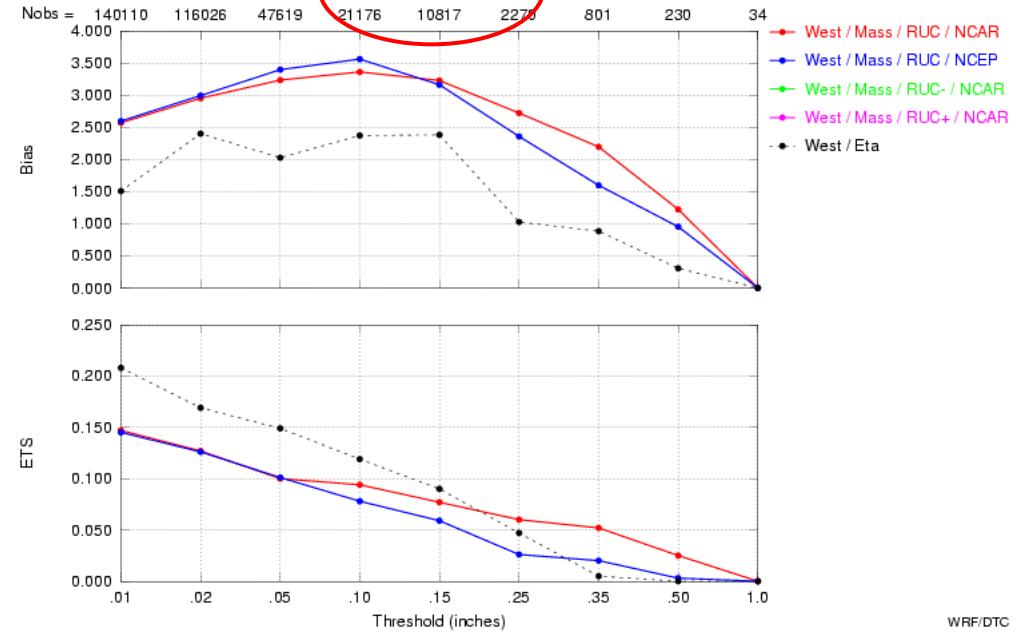


WRF/DTC

Precipitation (3-hrly) Forecast Hour=3 February 1 - 28, 2003



Precipitation (3-hrly) Forecast Hour=24 February 1 - 28, 2003

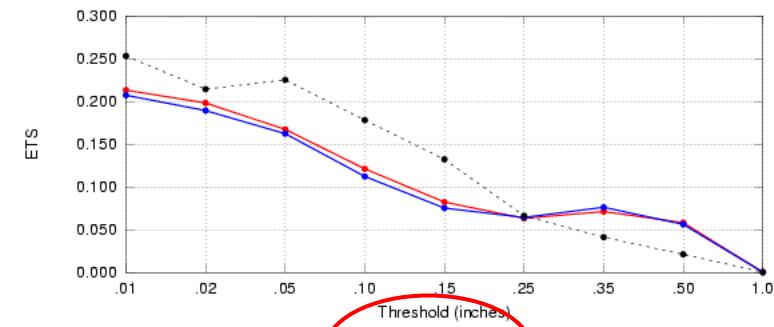


3 hour accumulations WRF:typical

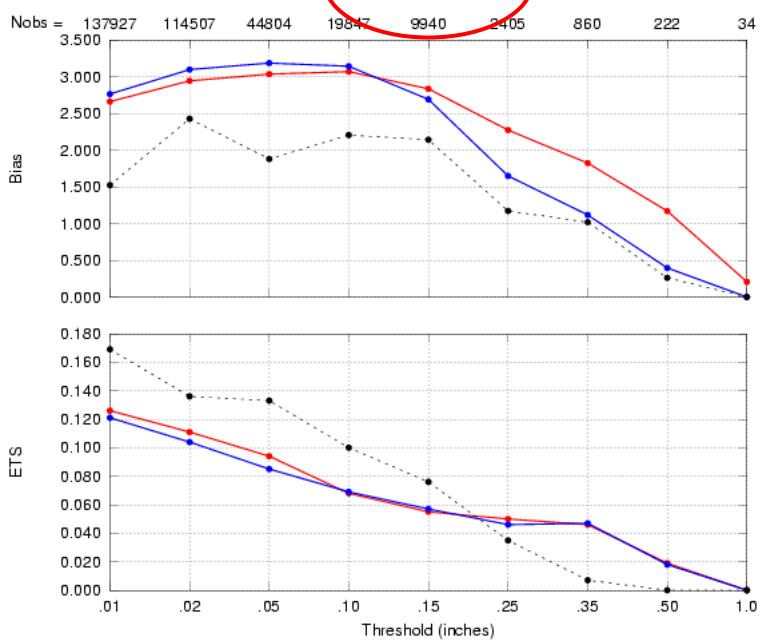
- overestimation at low threshold
- underestimation at high threshold

ETA:

- less overestimation
- Higher ETS low threshold
 - (coarser model)

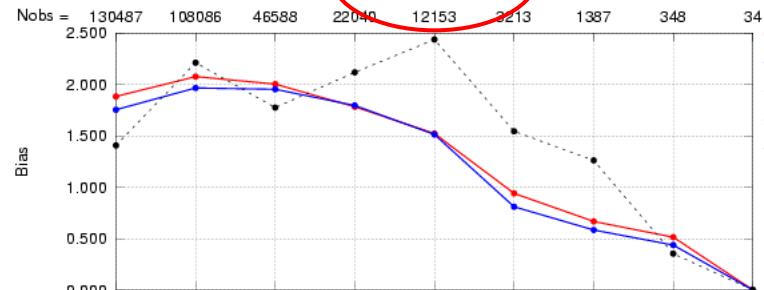


Precipitation (3-hrly) Forecast Hour=48 February 1 - 28, 2003

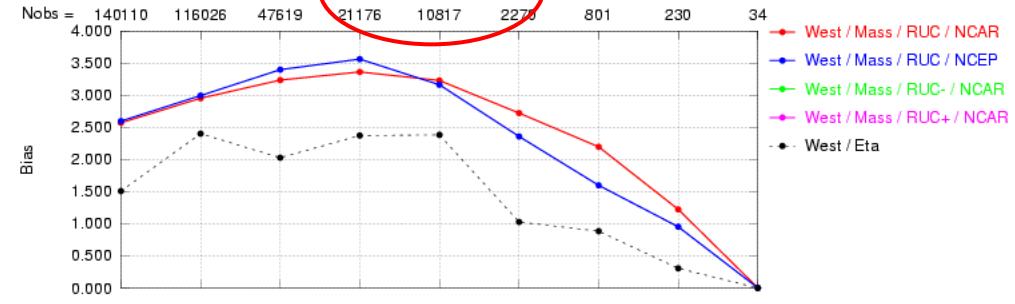


WRF/DTC

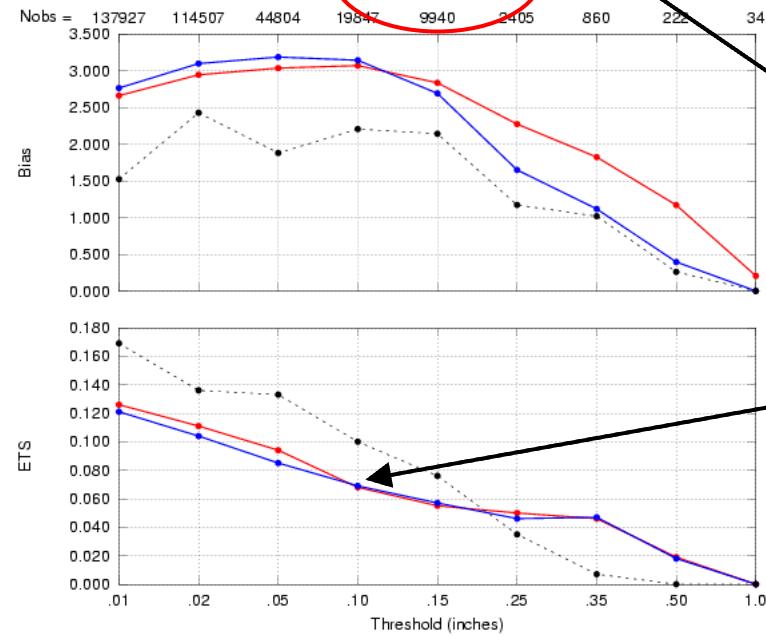
Precipitation (3-hrly) Forecast Hour=3 February 1 - 28, 2003



Precipitation (3-hrly) Forecast Hour=24 February 1 - 28, 2003

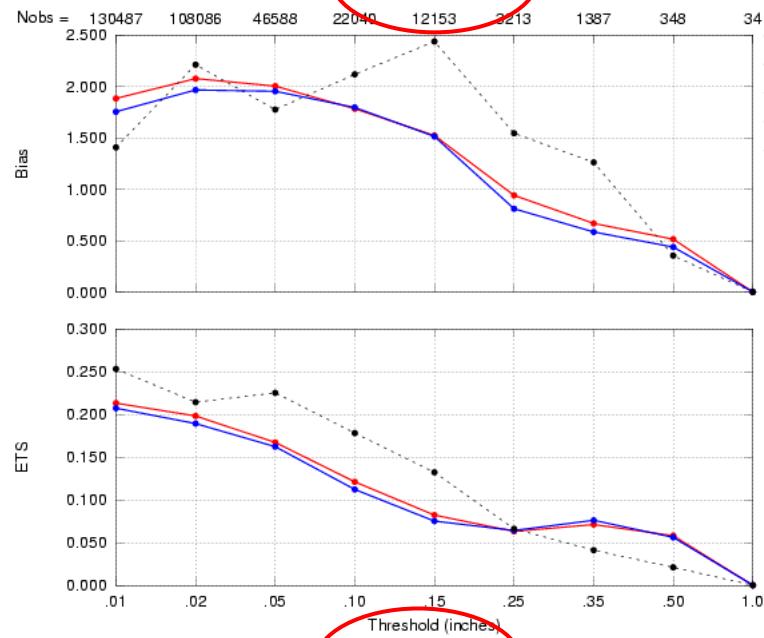


Precipitation (3-hrly) Forecast Hour=48 February 1 - 28, 2003

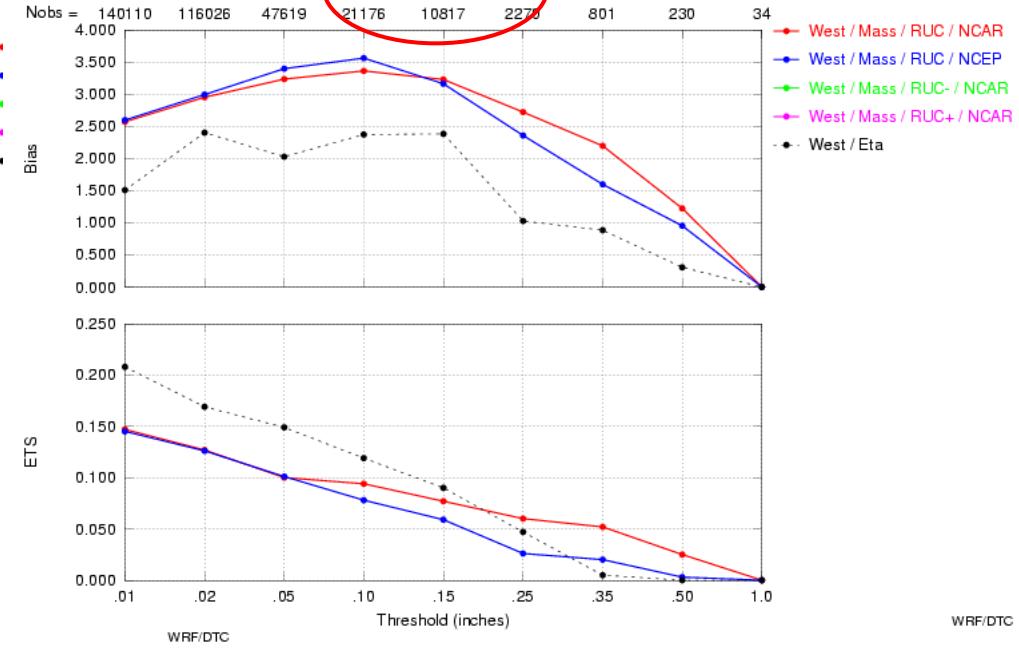


- ETS gets worse in time
- NCAR Physics- 0.1 in:
 - 3 h ->0.12
 - 24 h->0.10
 - 48 h ->0.07

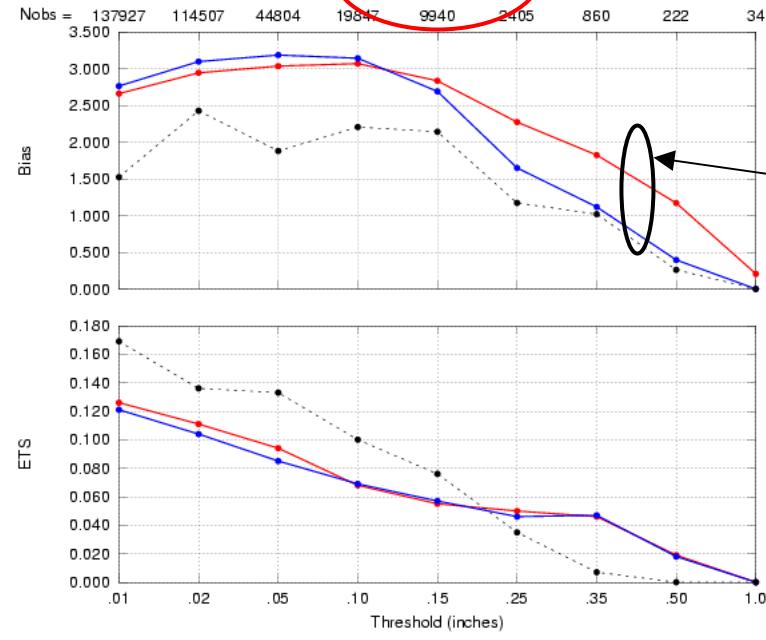
Precipitation (3-hrly) Forecast Hour=3 February 1 - 28, 2003



Precipitation (3-hrly) Forecast Hour=24 February 1 - 28, 2003

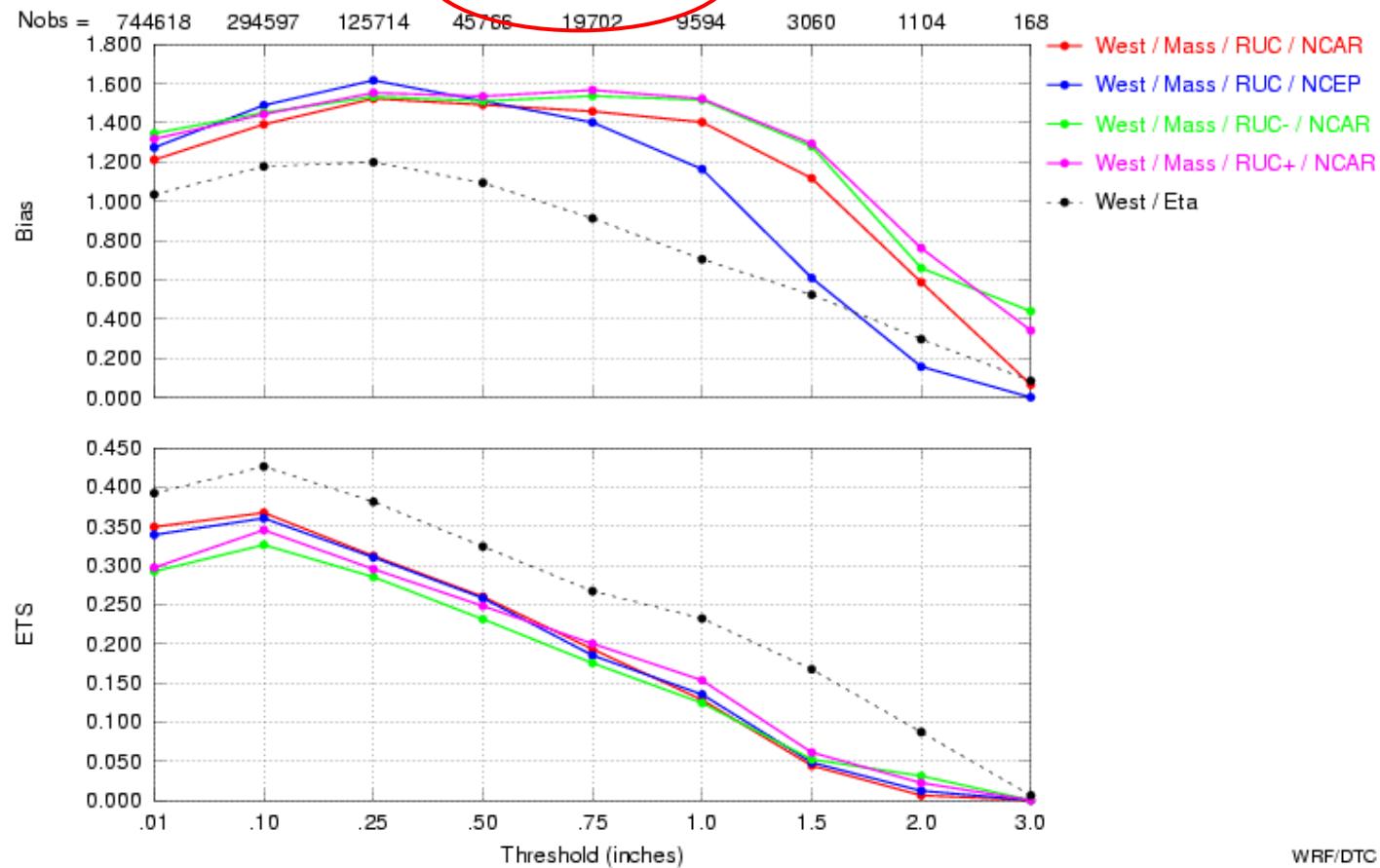


Precipitation (3-hrly) Forecast Hour=48 February 1 - 28, 2003

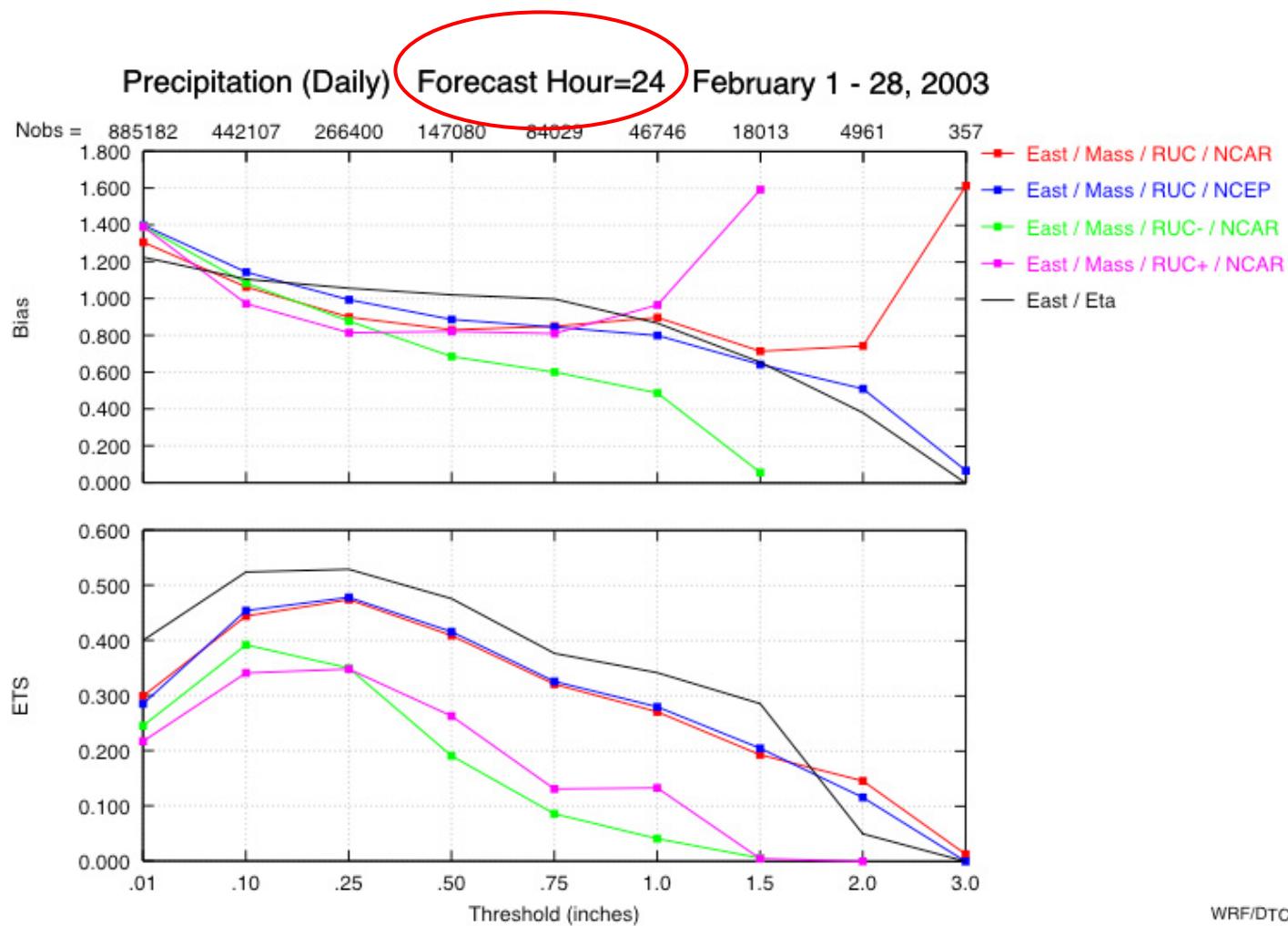


- High threshold
- PCAR more precipitation

Precipitation (Daily) Forecast Hour=24 February 1 - 28, 2003



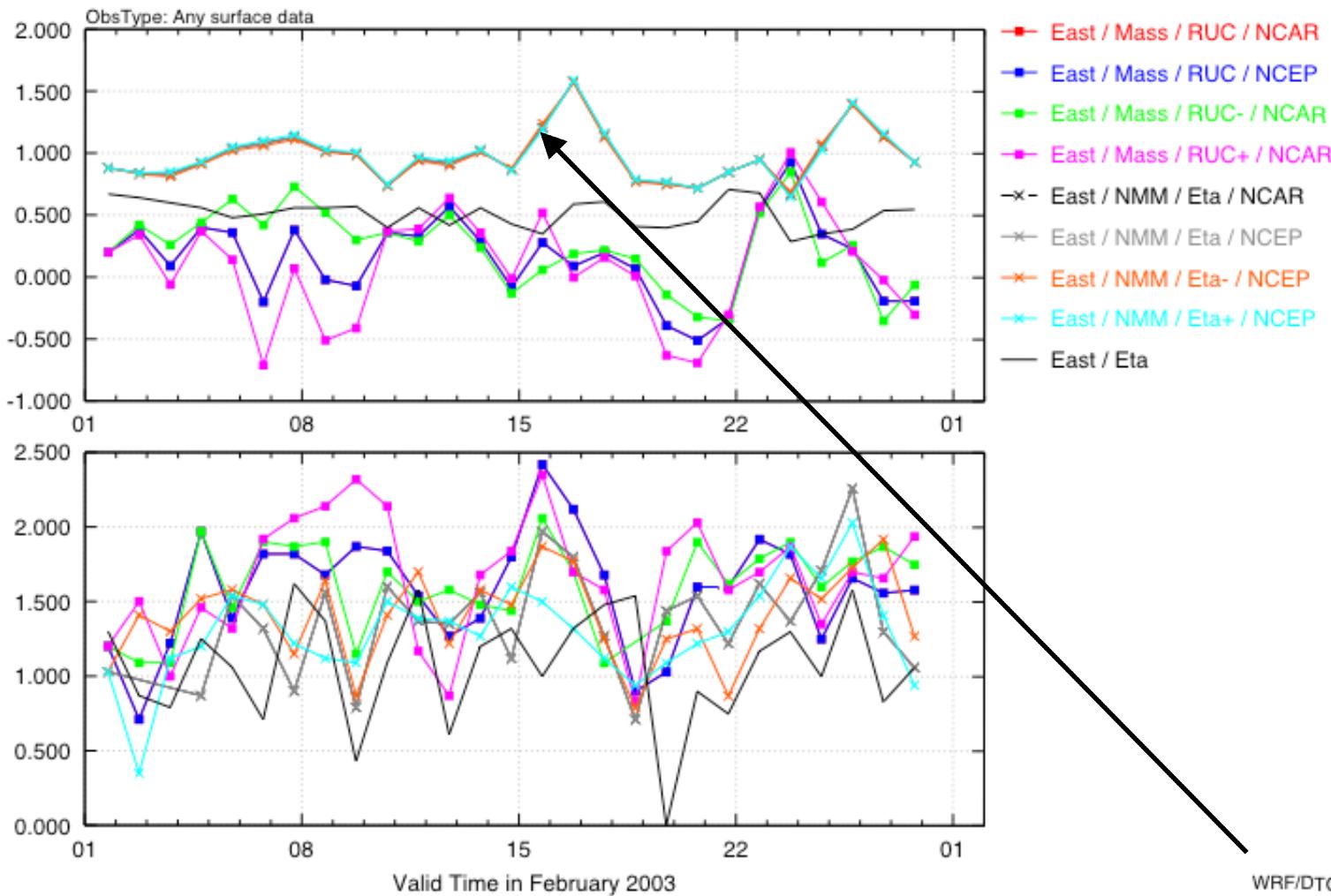
Bias: NCEP physics produces less precip at higher thresholds
 All WRFs have similar ETS; ETA is higher.
 ETA for 24 hr bucket is higher than for 3 hr bucket.



Eastern Domain:

- More difference between members
- Suspicious bias at high thresholds

SLP Forecast Hour=0 February 1 - 28, 2003



Hour 0 SLP forecast: NMM-ETA

- Higher bias
- Bias: all NMM members together